SAMSUNG

ELECTRONICS

Approval

LEAD-FREE

TO   : SONY

DATE   : Jul. 6, 2009.

SAMSUNG TFT-LCD

MODEL NO. : LTN140AT08-S01

NOTE : Extension code [-S]
                → LTN140AT08-S01
          Surface type [**Glare**]

<u>Any Modification of Spec is not allowed without SEC' permission</u>

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PREPARED BY :   *John Lee*

Application engineering part, TCS Team
Samsung Electronics Co., Ltd.

wise view™

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REVISION HISTORY

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Date	Revision No.	Page	Summary
Apr. 1, 2009	P00	All	The Preliminary specification of LTN140AT08-S01 was issued first.
Apr. 17. 2009	P01	P.10	Main Frequency was updated. (Min. & Max.)
		P.19	Timing parameter was updated. (Min. & Max.)
July. 6. 2009	A00	All	The Approval specification of LTN140AT08-S01 was issued first.

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GENERAL DESCRIPTION

DESCRIPTION

LTN140AT08-S01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a backlight system. The resolution of a 14.0" contains 1366 x 768 pixels and can display up to 262,144 colors. 6 O'clock direction is the Optimum viewing angle.

FEATURES

- High contrast ratio, high aperture structure
- 1366 x 768 pixels resolution
- Color Gamut Typ. 45%
- Fast Response Time
- Low power consumption
- LED BLU Structure
- DE (Data enable) only mode.
- 3.3V LVDS Interface
- On board EDID chip
- RoHS Compliance

APPLICATIONS

- Notebook PC
- If the usage of this product is not for PC application, but for others, please contact SEC

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	309.399(H) X 173.952(V) (14.0"diagonal)	mm	
Driver element	a-si TFT active matrix		
Display colors	262,144		
Number of pixel	1366 x 768	pixel	16 : 9
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.2265(H) x 0.2265(V)	mm	
Display Mode	Normally white		
Surface treatment	Haze 0, Hard-Coating 3H		

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Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	319.9	320.4	320.9	mm	
	Vertical (V)	186.6	187.1	187.6	mm	w/o converter
		-	198.6	-		w converter
	Depth (D)	-	-	3.6	mm	(1)
	Weight	-	-	330	g	

Note (1) Measurement condition of outline dimension
  . Equipment : Vernier Calipers
  . Push Force : 500g·f (minimum)

## 1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Storage temperate	TSTG	-20	60	°C	(1)
Operating temperate (Temperature of glass surface)	TOPR	0	50	°C	(1)
Shock (non-operating)	Snop	-	240	G	(2),(4)
Vibration (non-operating)	Vnop	-	2.41	G	(3),(4)

Note   (1) Temperature and relative humidity range are shown in the figure below.
  95 % RH Max. $(40 \, °C \geq Ta)$
  Maximum wet - bulb temperature at 39 ^{O}C or less. (Ta > 40 °C) No condensation

Relative Humidity (%RH)

(40,90)

Operating Range

(50,50.4)

(60,27.7)

Storage Range

Temperature (^{O}C)
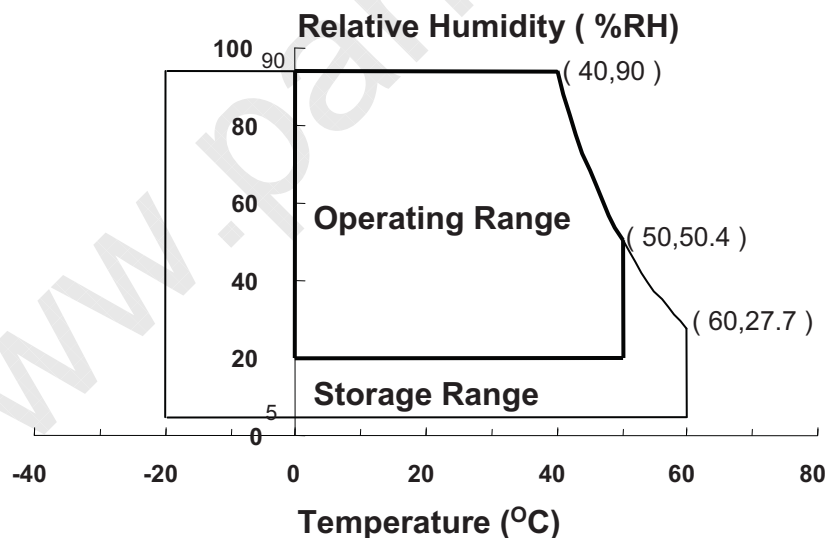
(2) 2ms, half sine wave, one time for ±X, ±Y, ± Z.
(3) 5 - 500 Hz, random vibration, 30min for X, Y, Z.
(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be hard and rigid enough so that the Module would not be twisted or bent by the fixture.

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1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

V_{DD} =3.3V, V_{SS} = GND = 0V

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)
Logic Input Voltage	V_{DD}	$V_{DD} - 0.3$	$V_{DD} + 0.3$	V	(1)

Note (1) Within Ta (25 ± 2 °C)

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3. ELECTRICAL CHARACTERISTICS

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3.1 TFT LCD MODULE

Ta= 25 ± 2°C

Item			Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply			V_{DD}	3.0	3.3	3.6	V	
Differential Input Voltage for LVDS Receiver Threshold		High	V_{IH}	-	-	100	mV	V_{CM} = +1.2V
		Low	V_{IL}	100	-	-	mV	
Vsync Frequency			fv	-	60	-	Hz	
Hsync Frequency			f_H	-	47.4	-	KHz	Vsync=60Hz
Main Frequency			f_{DCLK}	67.4	72.3	105.8	MHz	
Spread Spectrum	Modulation rate		Fmr	-2	-	+2	%	Center Spreading
	Modulation freq.		Fmf	30	-	300	Khz	
Rush Current			I_{RUSH}	-	-	1.5	A	(4)
Current of Power Supply	White		I_{DD}	-	340	-	mA	(2),(3)*a
	Mosaic			-	360	-	mA	(2),(3)*b
	V. Stripe			-	380	500	mA	(2),(3)*c

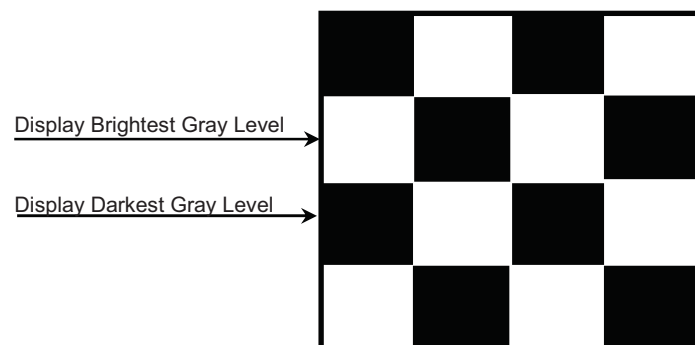Note (1) Display data pins and timing signal pins should be connected.(GND = 0V)

(2) fv = 60Hz, f_{DCLK} =72.3MHZ, V_{DD} = 3.3V , DC Current.

(3) Power dissipation pattern

*a) White Pattern

VIEW AREA

*b) Mosaic Pattern

Display Brightest Gray Level

Display Darkest Gray Level
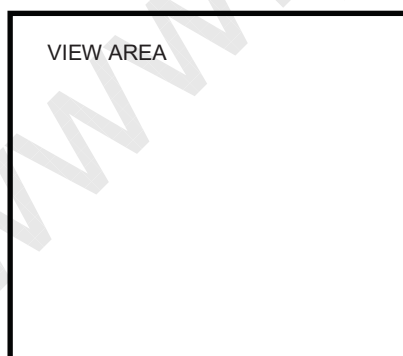
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*c) 1dot Vertical stripe pattern

R	G	B	R	G	B	R	G	B	R	G
R	G	B	R	G	B	R	G	B	R	G
R	G	B	R	G	B	R	G	B	R	G
R	G	B	R	G	B	R	G	B	R	G
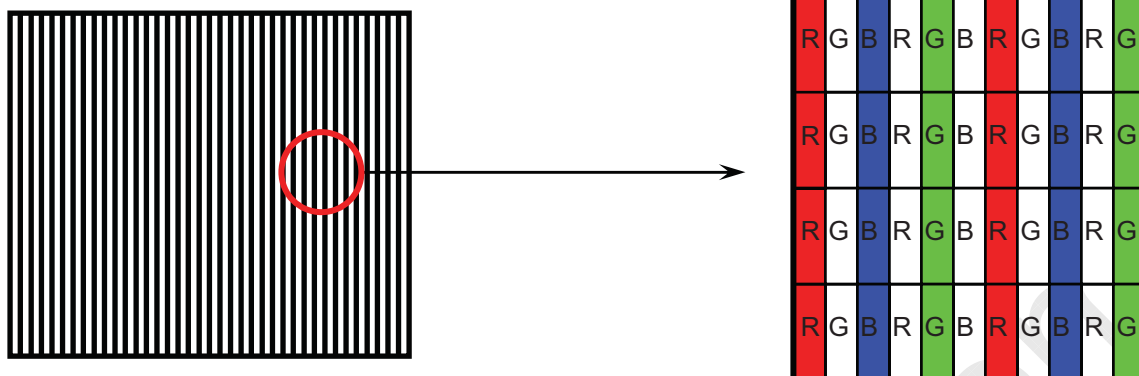
4) Rush current measurement condition

3.3V

M1
2SK1059

R1
47K

FUSE

C1
1uF

V_{DD} (LCD INPUT)

CONTROL SIGNAL
(HIGH to LOW)

R2
1K

M2
2SK1399

12V

R3
47K

C2
10000pF

C3
1uF

V_{DD} rising time is 470us

0.9V_{DD} 3.3V

0.1V_{DD}

GND

470us

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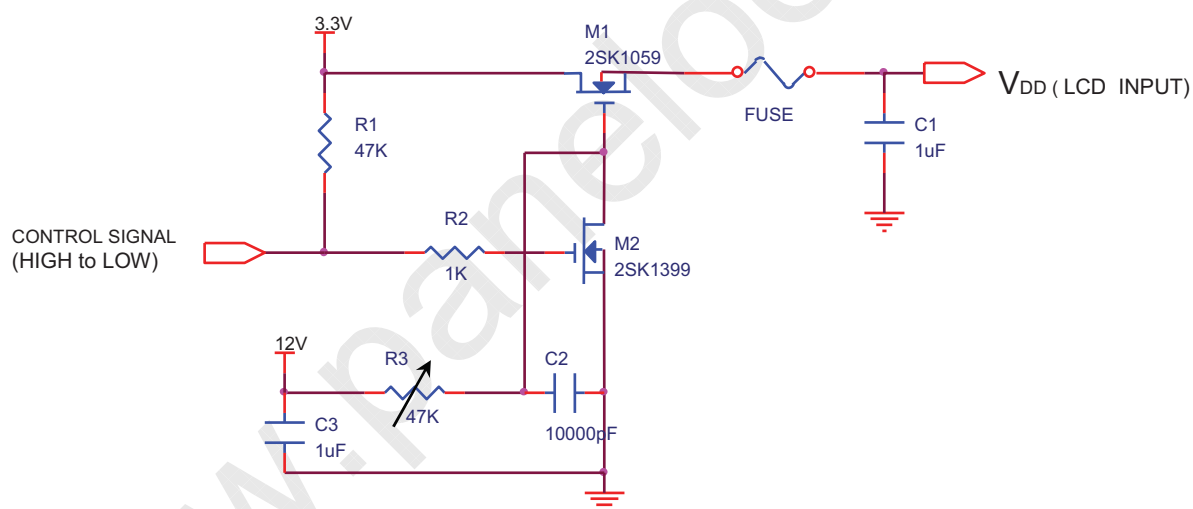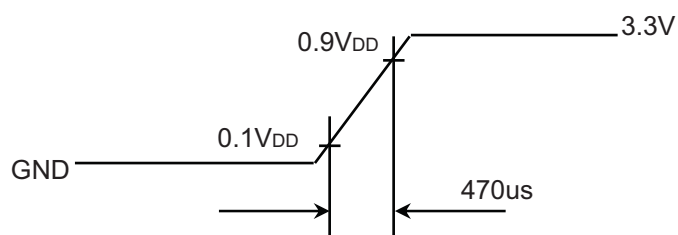
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3.2 BACK-LIGHT UNIT

Ta= 25 ± 2 ℃

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	IF	-	20	-	mA	
LED Forward Voltage	VF	-	3.2	3.4	V	
LED Array Voltage	VP	-	19.2	20.4	V	VF X 6 LEDs
Power Consumption	P	-	3.0	-	W	(IF X VF X 42LEDs) (6 serial, 7 parallel)
Operating Life time	Hr	10,000			Hr	(1)

Note (1) Life time (Hr) of LEDs can be defined as the time in which it continues to operate under the
condition Ta= 25 ± 2 ℃ and IF = 19 mA until below event occurs.
- When the brightness becomes 50% or lower than the original.

3.3 LED Driver

- On board LED Driver (Manufacturer : SEC)

Ta= 25 ± 2 ℃

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V_{in}	7	12	21	V_{LED}	
Input Current	I	-	280	-	mA	RMS
Enable Control Level	V	0	-	3.3	V	ON Level : 2V~3.3V OFF Level : 0V ~ 0.5V
External PWM Dimming Control Frequency (BLIM)	F_{BLIM}	0.2	-	1	kHz	High Level : 1.5V~3.3V Low Level : 0V ~ 0.1V
PWM Control Duty Ratio	D	5	-	100	%	(1)

Note (1) The operation of LED Driver below minimum dimming ratio may cause flicking or reliability issue.

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4. BLOCK DIAGRAM

4.1 TFT LCD Module

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I²C bus

EDID EEPROM

LVDS

Input-Connector
I-PEX 20455-040E-0 or Compatible

LVDS Input/RSDS Output Timing Controller

RSDS

DC-DC Converter

Gamma Generator

VCOM Generator

Gate Pulse Generator

SOURCE PCB

Source Driver IC

14.0" HD TFT-LCD Panel

Gate IC

→ Video Signal
→ Control Signal
→ VCOM
→ Gamma
→ DVDD
→ AVDD
→ Von/Voff

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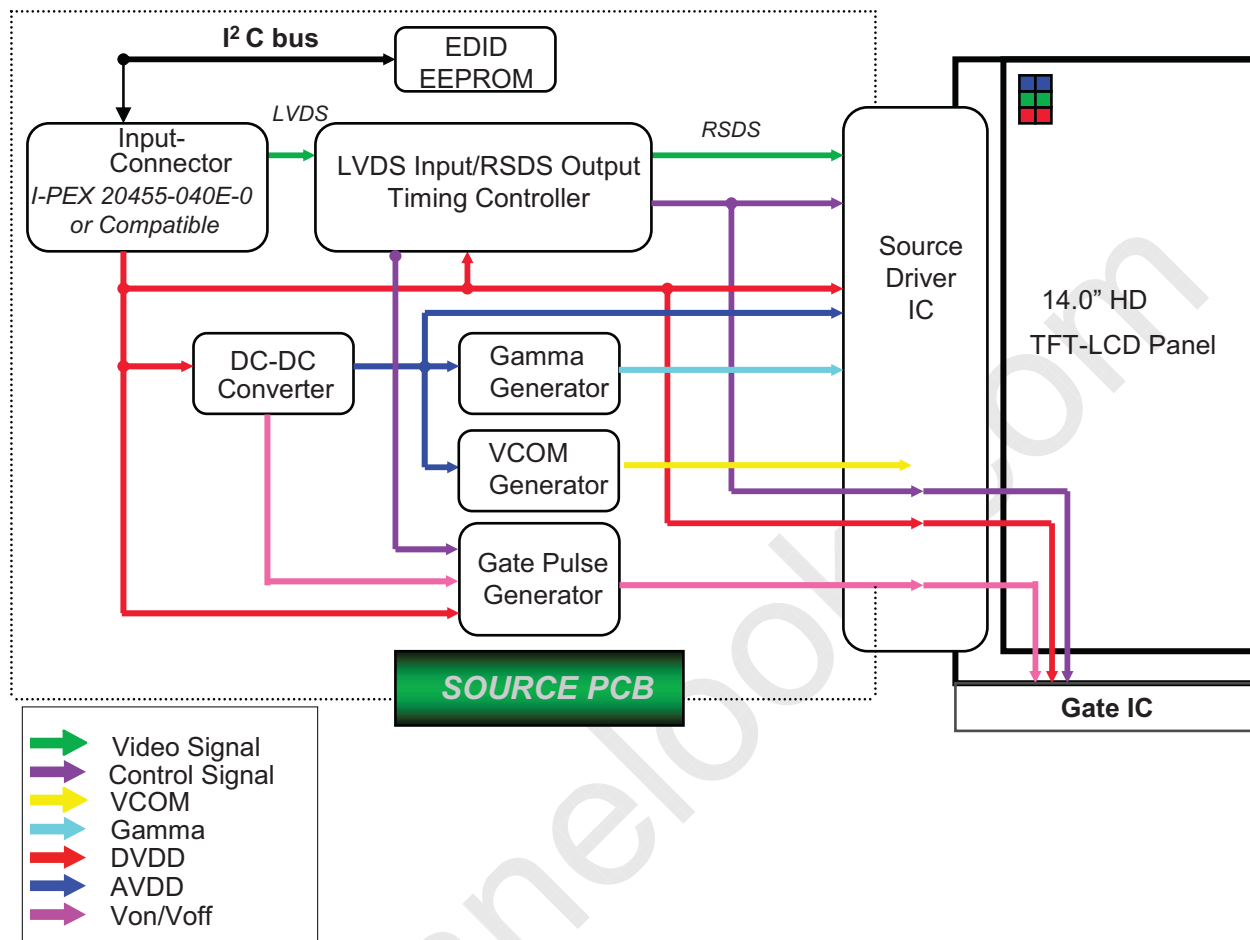
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5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (LVDS, Connector : I-PEX 20455-040E-0 or equivalent)

| Pin	Symbol	Function
1	NC	No Connection
2~3	VDD	Power Supply, 3.3V (typical)
4	VEDID	EDID 3.3V power
5	NC	No Connection
6	CLK	EDID clock
7	DATA	EDID data
8	RIN0-	- LVDS differential data input (R0-R5, G0)
9	RIN0+	+ LVDS differential data input (R0-R5, G0)
10	GND	Ground
11	RIN1-	- LVDS differential data input (G1-G5, B0-B1)
12	RIN1+	+ LVDS differential data input (G1-G5, B0-B1)
13	GND	Ground
14	RIN2-	- LVDS differential data input (B2-B5,HS,VS, DE)
15	RIN2+	+ LVDS differential data input (B2-B5,HS,VS, DE)
16	GND	Ground
17	CLK-	- LVDS differential clock input
18	CLK+	+ LVDS differential clock input
19	GND	Ground
20 ~ 21	NC	No Connection
22	GND	Ground
23 ~ 24	NC	No Connection
25	GND	Ground
26 ~ 27	NC	No Connection
28	GND	Ground
29 ~ 30	NC	No Connection
31 ~ 33	VLED_GND	LED Ground
34	NC	No Connection
35	BLIM	PWM for luminance control (200 ~ 1KHz, 3.3V, 5 ~ 100%)
36	BL_Enable	BL On/Off (On : 2.0 ~ 3.3V, Off : 0 ~0.5V)
37	NC	No Connection
38~40	VLED	LED Power Supply (7V-21V)

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5.2 LVDS Interface : Transmitter SN75LVDS86 or Compatible

Pin No.	Name	RGB Signal	Pin No.	Name	RGB Signal
44	TxIN0	R0	12	TxIN11	G5
45	TxIN1	R1	13	TxIN12	B0
47	TxIN2	R2	15	TxIN13	B1
48	TxIN3	R3	16	TxIN14	B2
1	TxIN4	R4	18	TxIN15	B3
3	TxIN5	R5	19	TxIN16	B4
4	TxIN6	G0	20	TxIN17	B5
6	TxIN7	G1	22	TxIN18	Hsync
7	TxIN8	G2	23	TxIN19	Vsync
9	TxIN9	G3	25	TxIN20	DE
10	TxIN10	G4	26	TxCLKIN	Clock

LVDS INTERFACE
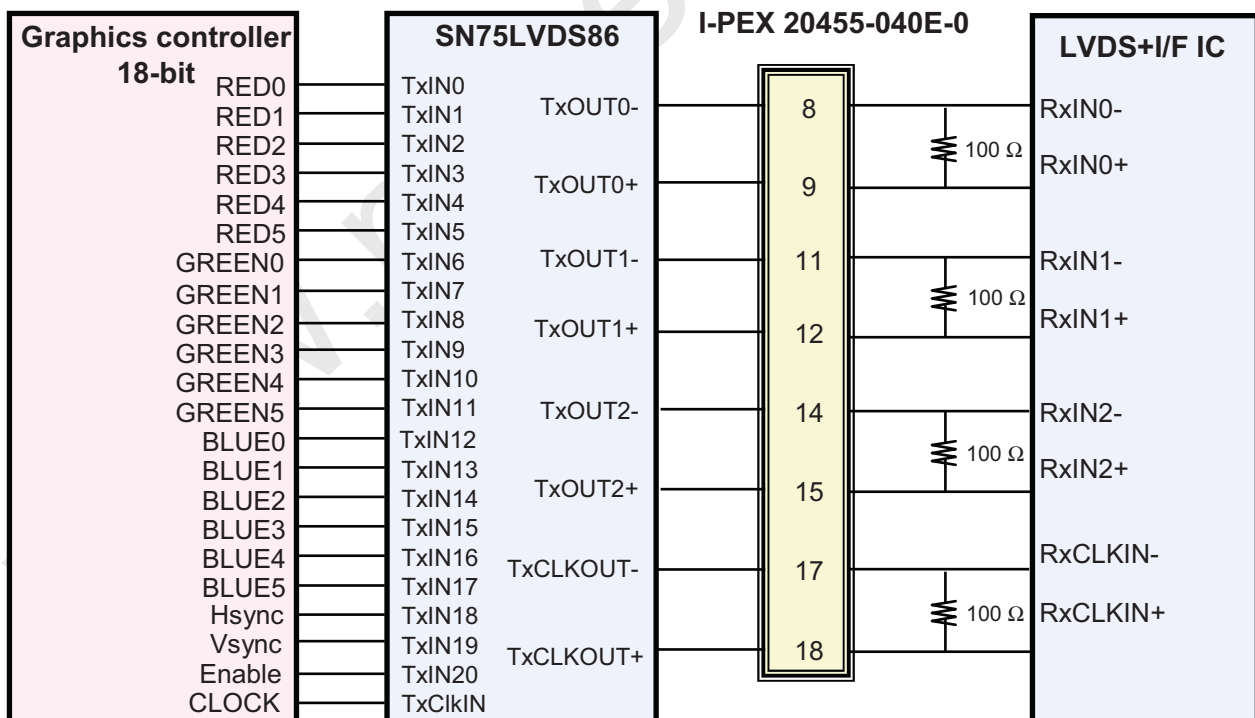
Note : The LCD Module uses a 100ohm resistor between positive and negative lines of each receiver input.

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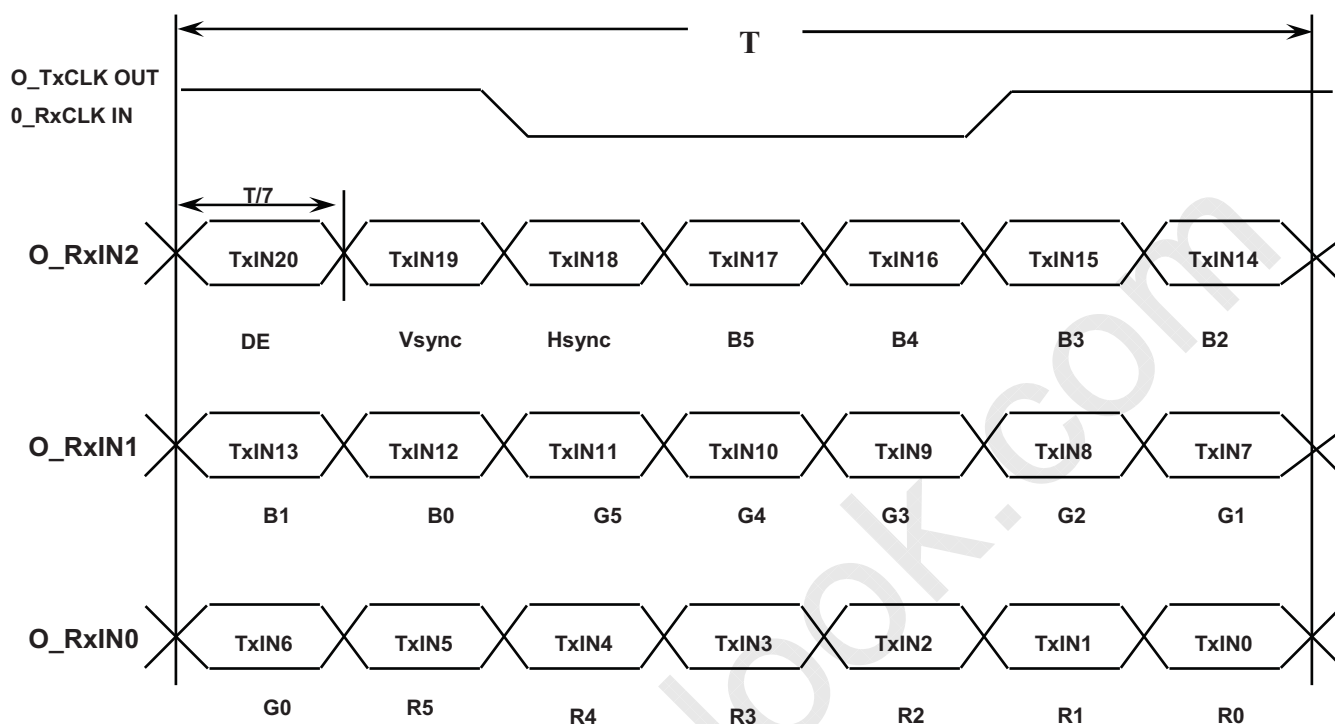5.3 Timing Diagrams of LVDS For Transmission

LVDS Receiver : Integrated T-CON

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5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

Color	Display	Data Signal																		Gray Scale Level
		Red						Green						Blue						
		R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	45	B5	
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	-
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	-
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	-
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	-
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	-
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	-
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
Gray Scale Of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	Dark	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
	↑	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~R60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R61
	Light	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R62
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	R63
Gray Scale Of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	Dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	G1
	↑	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	G2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~G60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	G61
	Light	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	G62
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	G63
Gray Scale Of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	Dark	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	B2
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~B60
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	↓	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	B61
	Light	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	B62
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	B63

Note 1) Definition of gray :
Rn: Red gray, Gn: Green gray, Bn: Blue gray (n=gray level)
Note 2)Input signal: 0 =Low level voltage, 1=High level voltage

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5.5 Pixel Format in the display

Pixel 1

Pixel 1366

Line 1

R G B R G B

R G B R G B

LTN140AT08-S01 Panel

Line 768

R G B R G B

R G B R G B

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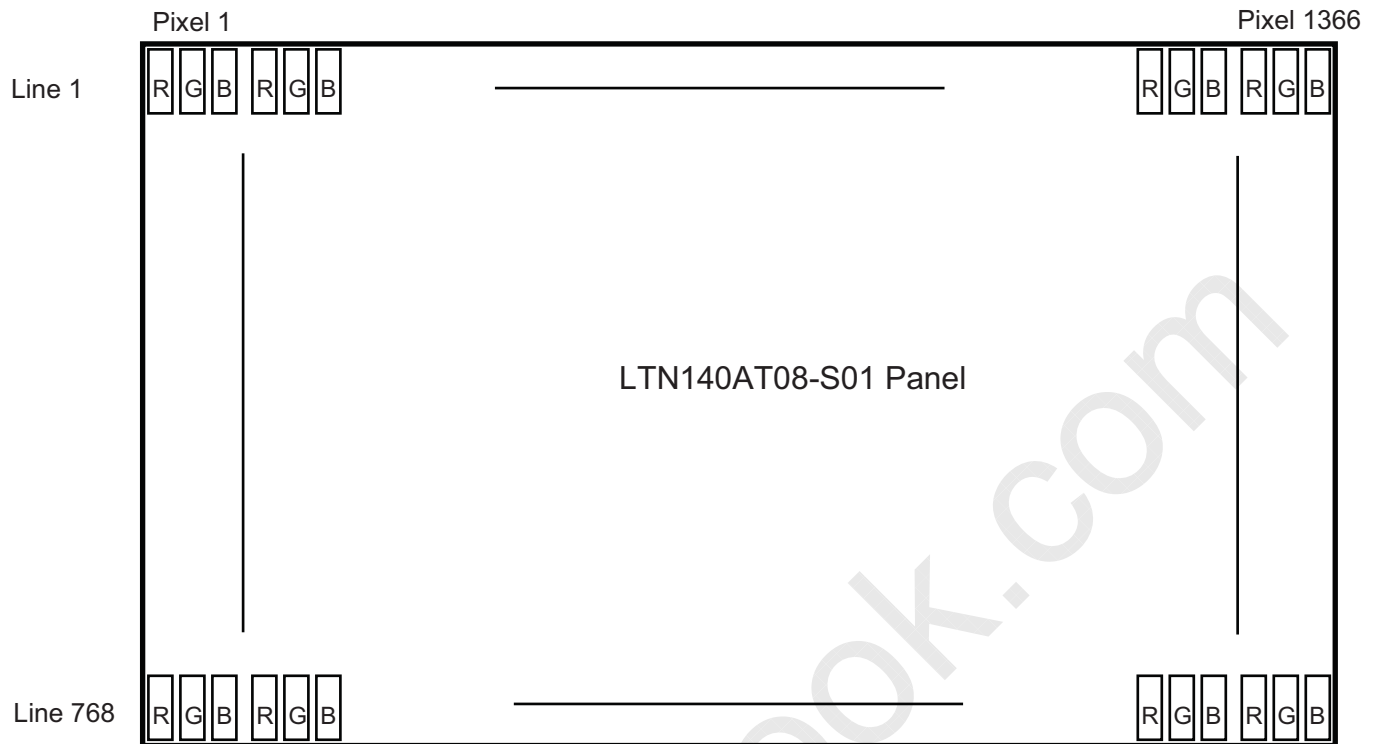
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6. INTERFACE TIMING

6.1 Timing Parameters

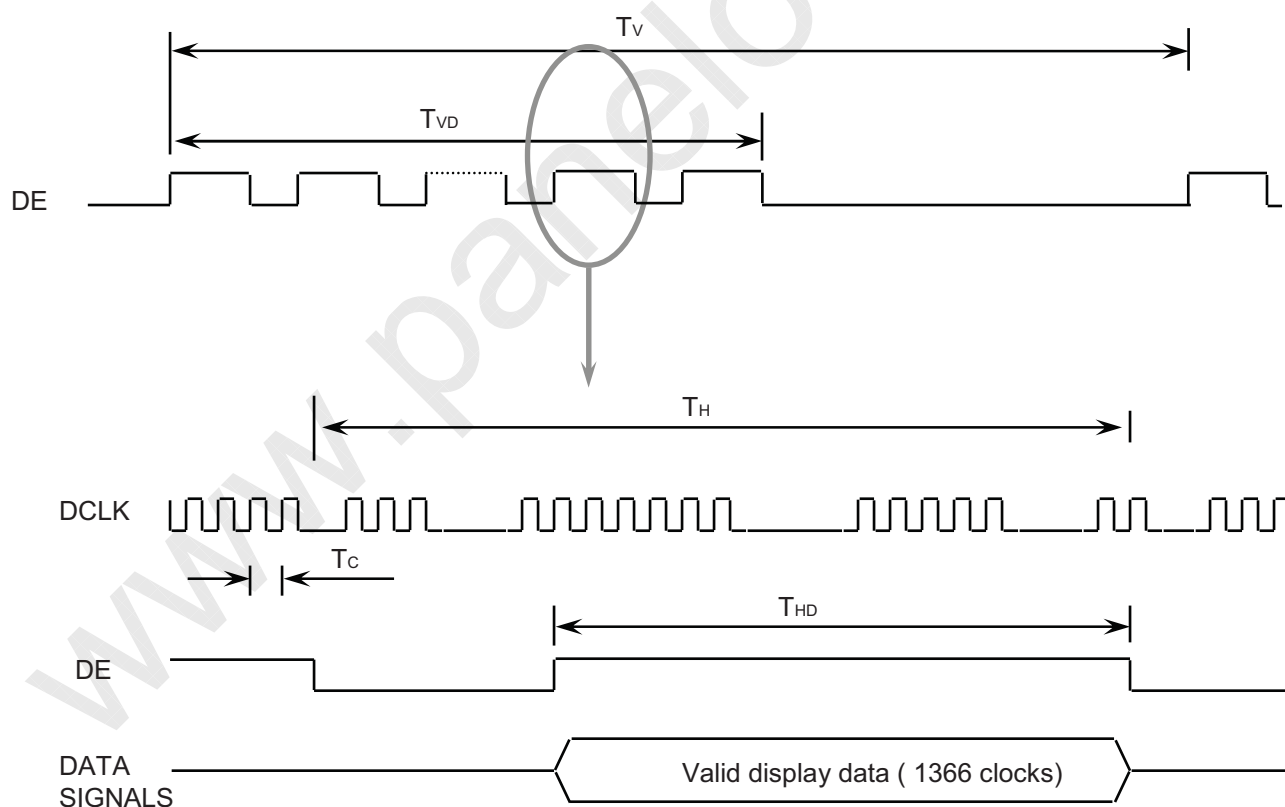| Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frame Frequency	Cycle	TV	780	790	980	Lines	-
Vertical Active Display Term	Display Period	TVD	-	768	-	Lines	-
One Line Scanning Time	Cycle	TH	1440	1526	1800	Clocks	-
Horizontal Active Display Term	Display Period	THD	-	1366	-	Clocks	-

6.2 Timing diagrams of interface signal

DE

T_V

T_{VD}

T_H

DCLK

T_C
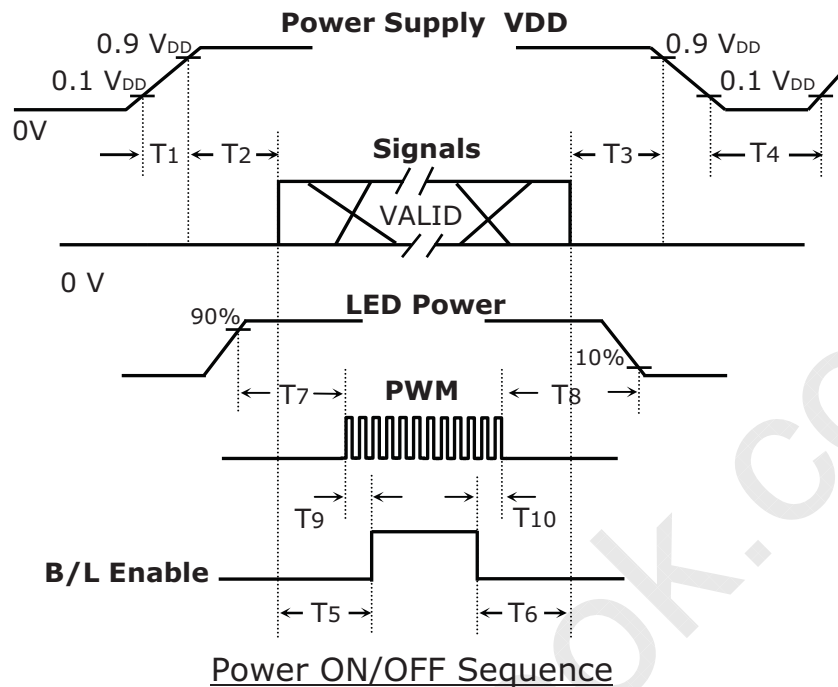
T_{HD}

DE

DATA SIGNALS   Valid display data (1366 clocks)

6.3 Power ON/OFF Sequence

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: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.

Power Supply VDD

0.9 V$_{DD}$ 0.9 V$_{DD}$
0.1 V$_{DD}$ 0.1 V$_{DD}$
0V
→ T1 ← T2 →   ← T3 → ← T4 →

Signals

VALID

0 V

LED Power

90%   10%
← T7 →   **PWM**   ← T8 →

T9   T10

B/L Enable

← T5 →   ← T6 →

Power ON/OFF Sequence

Timing (ms)	Remarks
$0.5 < T_1 \leq 10$	V_{DD} rising time from 10% to 90%
$0 < T_2 \leq 50$	Delay from V_{DD} to valid data at power ON
$0 < T_3 \leq 50$	Delay from valid data OFF to V_{DD} off at power OFF
$500 \leq T_4$	V_{DD} OFF time for Windows restart
$200 \leq T_5$	Delay from valid data to B/L enable at power ON
$200 \leq T_6$	Delay from valid data off to B/L disable at power OFF
$0 < T_7$	Delay from LED driver power ON to PWM ON
$0 < T_8$	Delay from PWM OFF to LED driver power OFF
$10 \leq T_9$	Delay from PWM ON to B/L Enable ON
$0 < T_{10}$	Delay from B/L Enable Off to PWM OFF

NOTE.
(1) The supply voltage of the external system for the module input should be the same as the definition of VDD.
(2) In case of VDD = off level, please keep the level of input signals on the low or keep a high impedance.
(3) T4 should be measured after the module has been fully discharged between power off and on period.
(4) Interface signal shall not be kept at high impedance when the power is on.

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7. MECHANICAL OUTLINE DIMENSION

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[Refer to the next page]

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114.53

26.25

* NOTE

1. INPUT SIGNAL CONNECTOR TO BE SPECIFIED AS BELOW.
   -MAKER / PART NO. : I-PEX / 20455-040E-02S
2. CALIPERS MEASURING FORCE :750 ± 150 gf
3. WEIGHT : 330g Max.
4. IN ORDER TO AVOID IC DAMAGE, IT IS NOT ALLOW THAT OVERLAPPING OF CABLES
   OR ANTENNAS, CAMERA, WLAN, WWAN, OVER THESE COF LOCATION.

4-0.8±0.2

3.6Max

198.6±0.5

187.14±0.5 [OUTLINE]

6.45

8.85

33
29.5±0.2
23.5±0.2
20

29
32.5±0.2
58.5±0.2
42

(50.25)

4-0.5
4-R1.2

173.952(Active Area)

(91.276)

11(PCB)

309.4(Active Area)

220(PCB)

320.4 [OUTLINE]

Active Center

(159.25)

4.3
4-Ø2.4

33
29.5±0.2
23.5±0.2
20

4.55

29
32.5±0.2
38.5±0.2
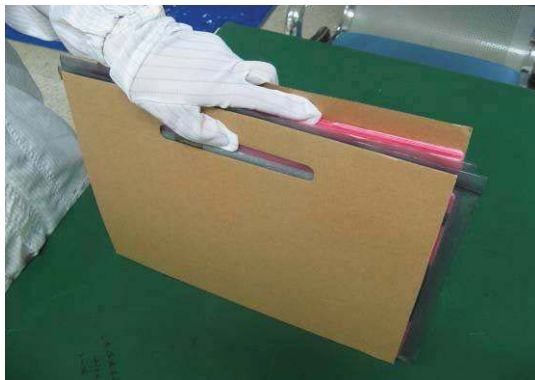42

(50.15)

3.2±0.2
6.5

3.2±0.2
6.5

FILE NO.

8. PACKING

1. CARTON(Internal Package)

(1) Packing Form
Corrugated Cardboard box and Corrupad form as shock absorber

(2) Packing Method

PACKING CASE

Note 1)Total Weight : Approximately 3.1 kg

2) Acceptance number of piling : 4 sets

3) Carton size : 428(W) * 359(D) * 322(H)

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(3)Packing Material

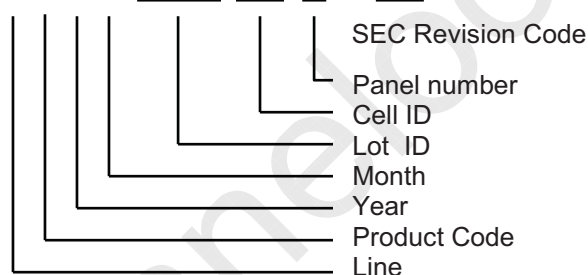| No	Part name	Quantity
1	Static electric protective sack	20
2	Packing case (Inner box) included shock absorber	1 set
3	Pictorial marking	2
4	Carton	1 set

9. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.
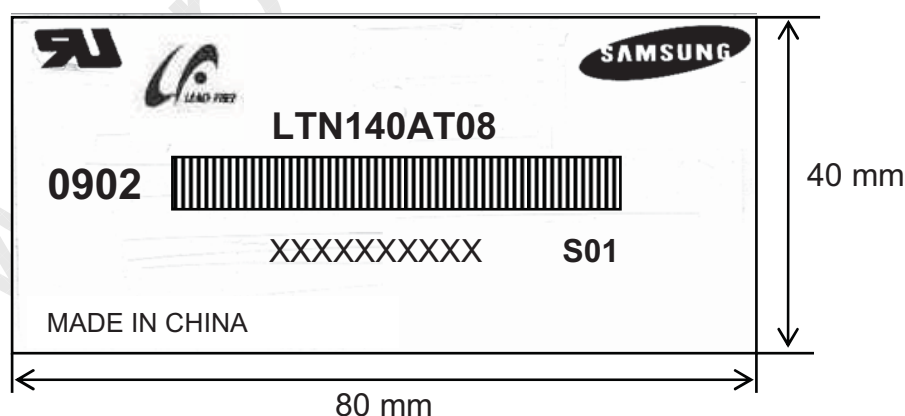
(1)Parts number : LTN140AT08
(2)Revision code : 3 letters
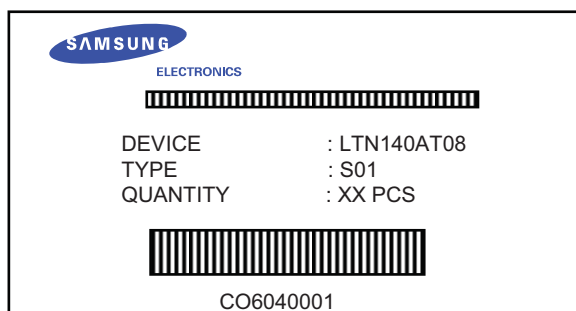(3)Lot number   : X X X X   XXX   XX   X   **S01**

                   SEC Revision Code
                   Panel number
                   Cell ID
                   Lot ID
                   Month
                   Year
                   Product Code
                   Line

(4) Nameplate Indication

LTN140AT08

0902 |||||||||||||||||||||||||||||||||

XXXXXXXXXX   S01

MADE IN CHINA

40 mm

80 mm

Parts name   : LTN140AT08
Lot number   : XXXXXXXXXX
Inspected work week   : 0902(2009 year, 2nd week)

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(5) Packing small box attach

SAMSUNG
ELECTRONICS

| | | | | | | | | | | | | | | | | | | | | | | | | | |

DEVICE   : LTN140AT08
TYPE   : S01
QUANTITY   : XX PCS

CO6040001

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10. GENERAL PRECAUTIONS

1. Handling

  (a) When the module is assembled, It should be attached to the system firmly
     using every mounting holes. Be careful not to twist and bend the modules.

  (b) Refrain from strong mechanical shock and / or any force to the module. In addition to
     damage, this may cause improper operation or damage to the module and LED back-light.

  (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch
     the surface harder than a HB pencil lead.

  (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time,
     Staining and discoloration may occur.

  (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

  (f) The desirable cleaners are water, IPA (Isoprophyl Alcohol) or Hexane.
    Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl
    chloride. It might permanent damage to the polarizer due to chemical reaction.

  (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or
     mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly
     with soap.

  (h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

  (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming
     inspection and assembly process.

  (j) Do not disassemble the module.

  (k) Do not adjust the variable resistor which is located on the back side.

  (l) Protection film for polarizer on the module shall be slowly peeled off just before use so
     that the electrostatic charge can be minimized.

  (m) Pins of I/F connector shall not be touched directly with bare hands.

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2. STORAGE

(a) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

3. OPERATION

(a) Do not connect,disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.3 " Power on/off sequence ".

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, SEC is not to be held reliable for the defective operations. It is strongly recommended to contact SEC to find out fitness for a particular purpose.

4. OTHERS

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time,it can be the situation when the image "sticks" to the screen.

(e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

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